MODIS TEAM MEETING

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March 12, 1996 Attendees are marked in **BOLD and Underlined**

The Following items are included in this package:

1) SBRC Weekly Submission Memos form week 224
2) CDRL-521 - MODIS Weekly Status Rpt. week ending 3-15-96
3) MODIS Technical Weekly
4) MODIS Monthly Report No. 54
5) Open SBRC Internal Memos Report

MODIS Technical Weekly **March 15, 1993**

Sent to MODIS.Review on March 18 at

The MODIS Quarterly Management Review will be held at Santa Barbara Remote Sensing on Tuesday, March 26. There will be splinter sessions on March 27.

Sal Cicchelli has provided a record of the recommendations by Eric Johnson, Cherry Congedo, and Sal on MODIS waivers D008B (Aft Optics Assembly vibration) and W014 (use of OBA S/N #2 for flight model 1). Sal, Eric, and Cherry have recommended approval of D008B subject to several conditions provided in Appendix I. Briefly, these conditions include:

1) modify acoustic procedure 152804 to include a microphone and accelerometer at the AOP to measure the effect of acoustic energy in the > 400 Hz range.
2) correct the description of the deviation/waiver and finalize contractual status of D008A.
3) strength qualify AOP CV2500 optics bond design via analysis and test

They recommend that W014 not be approved and then be reconsidered upon resolution of several actions described in Appendix I. Briefly, these would include the following actions on SBRS:

1) Re-examine FEA model accuracy for determining stresses
2) Provide notch extension rationale for qualification levels for purposes of stress calculations.
3) Show MODIS fracture control requirements are satisfied for all structural bondlines in PFM and flight units.
4) Evaluate consequences of higher levels from direct impingement acoustics on the OBA in the high frequency region.
5) Provide instrument mechanical verification test plan(s), explicitly stating load spectra as soon as possible
6) Provide more descriptive title and description to waiver.

There is a memo from Al DeForrest that both mainframe structures were built to flight documentation. Ed Tani has read Tom Endo's recommendations and then completed his own life analysis based on composite materials and know life consumption factors. This will be in memo R05712. Al concludes we can continue with all planned vibration events for PFM without damage and Ed supports the F1 waiver for use even though this unit saw qualification level vibration testing.

We will discuss these issues further with our GSFC structural engineers and determine if some of the analyses suggested by our team could be performed in-house.

Jose Florez reported on the electronics telecon with SBRS. Cal Control 1 and Cal Control 2 Circuit Card Assembly (CCA) is a concern. SBRS has suggested starting Main Electronics Module (MEM) testing even if one or both of the Cal CCAs are not in the

MEM. Based on discussions with GSFC, SBRS would use dummy cards with simulated power dissipation.

In the last portion of Jose's report, he provides inputs from Ed Clement on the Forward viewing Analog Module (FAM) PC crosstalk problem and resolution. SBRS has determined that the crosstalk effect does not cause a problem if the transitions of the Delayed Pixel Clock are moved to times when ADC conversions are not taking place. This means about 10 jumpers and isolation pads per CCA. The adjustable range of the clock will be moved back and the pulse width reduced. The changes will assure desired clock phasing and improve system adjustability.

Bruce Guenther provided a draft of comments of science on priorities for testing resulting from a telecon with several science team members on March 8. The teleconference review of the latest version of the SBRS I&T schedule was conducted to identify potential areas for test reductions and to establish science and calibration priorities for key test events. The time planned for several important calibration and characterization tests looks optimistic. There may be possibilities for saving time in other areas by going directly to PFM electronics, reducing or deleting mass properties and acoustics tests, reducing system level EMI/EMC tests, and reducing time for S/C interface simulation. It may also be possible to reduce or eliminate some parts of the SIS 100 radiance calibration tests, the T/V tests, and the stray light performance verification tests if Point Spread Function measurements are completed at the system level. The Preship Data Package might be able to be prepared in parallel with other tests. Bruce believes the time for Bench Acceptance Tests at LMAS might be able to be reduced. Bruce identifies 17 follow-up action items.

Ed Knight has three technical inputs:
a) Ed identifies small changes to the SBRS test procedures that would enhance our ability to collect the pre-launch value of the OBC BB emissivity that we need for thermal calibration. Ed's recommended changes to RC02 and MFI-09 require SBRS to collect a few additional scans of data. No new tests are added.
b) Ed recommends that the initial activation of MODIS post-launch include some "closed door" measurements that were made pre-launch. For example, the inside of the Earth view door could be scanned as a functional test and pattern noise test. The SRCA could be turned to check radiometric stability.
c) This addresses the December QMR concern about time-stamping the data. There were two concerns. There were some incorrect time codes in the headers which MCST understands have been corrected. The second concern was that the time stamps on the instrument data match the time stamps on the GSE data. MCST understands that SBRS is providing unique templates and setting time tags close enough that detective work through the GSE files is possible, if needed. This section includes several email messages which led up to Ed's message that MCST believes that SBRS is meeting their concerns regarding time-stamping of the data.

Bob Martineau writes that all flight model 1 (F1) Focal Plane Assemblies (FPAs) and the F2 VIS and NIR FPAs have been delivered. The F2 LWIR Detective Assembly (DA) and the F2 S/MWIR DA have completed radiometric testing. Neil Therrien will investigate using -9 volt rails for the NIR FPA.

John Mehrten provided several inputs on flight operations:
a) MODIS Reset/Upload Brief Description - The details are described by J. Auchter. Then a possible conflict is mentioned. In the upload mode, the MODIS instrument can not generate housekeeping telemetry. The options are to disable this subaddress or enable it with a flag indicating no data. There is a question whether or not either of these approaches would set off S/C or ground alerts.
b) OASIS Cmd Hazard Msgs - A possible way to list commands as Hazardous, Constraint, Test, or Advisory is mentioned. John identifies this as a possible topic for the upcoming (4/96) operations workshop.
c) Ops Activity Remarks/C&T Status - John provides remarks on Ed's message plus a status/advance outlook at the 151840 MODIS C&T document. This also includes a MODIS modes update. Ed and Kirsten's memo on "Sample Scheduling Data Needs" is included.
d) RE: Ops Activity Remarks/C&T Status - Command count correction and FYI count on number of H, C, T, or A commands.
e) MODIS Ops Issues - FYI and potential topics for 4/96 operations meeting. This includes MODIS resets/uploads, application process identifications (APIDs), and a strawman of initial on-orbit activities.
f) RE4CW: EOS-AM Initial Instrument Ops - John assumes the instruments will be able to turn on some subsystems and do limited operations with the doors closed during the 8 days to get to the designated EOS orbit. This includes comments from Claire Wilda which she placed on John Mehrten's 6 March 96 email "EOS-AM Initial Instrument Ops". Two of Claire's comments:
1) MODIS has said that turn on must be between 12 and 20 hours from launch vehicle separation.
2) We won't get to orbit (and will still be firing thrusters) for eight days.

MR
3/18/96

APPENDIX

I. Sal Cicchelli (recommendations and actions concerning waivers VJ50-D008B and VJ50-W014 made by Eric Johnson, Cherie Congedo and Sal Cicchelli)

Author: Sal Cicchelli <scicchel@div720.gsfc.nasa.gov> at Internet
Date: 3/10/96 10:47 AM
Subject: Recommendations On MODIS Waivers D008B and W014 (OBA Vibrat
---------- Message Contents ----------
References:
1. GSFC memo " REVIEW OF MODIS OBA Random Test Levels" , from Eric Johnson et al. to Mike Roberto et al., dated 3-8-96.

2. SBRC memo " AOA Random Vibration Notch Rationale ", # R00572, dated 1-2-96.

3. SBRC memo " MODIS- Discussion of OBA Vibration Level Discrepancies", # R03816, dated 4-8-94.

4. SBRC memo " Recommendation for Using the Engineering Model AOP and ATB as MODIS Flight Hardware, # R05333, dated 10-13-95.

The following is a record of recommendations and actions concerning waivers VJ50-D008B and VJ50-W014 made by Eric Johnson, Cherie Congedo and Sal Cicchelli:

A. D008B:

RECOMMENDATIONS: Approve "Proposed Acceptance" Tables 4,5,6 and Fig. 4,5,6 only, for the Protoflight Unit only, with the understanding that these test levels do not constitute a notching criterion for instrument qualification testing. Further, waiver approval should be contingent on resolution of the D008 Action items, below.

ACTIONS: 1. Modify Acoustic Procedure, SBRC document 152804, to include a microphone and accelerometer at the AOP Optics location; this is for measuring the effect of acoustic energy in the > 400 Hz range.

2. Make the following contractual corrections to the waiver:

a. Item 22: Description of Deviation/Waiver:
D008B is not a revision to D008A; it is a revision to the original waiver D008. "Current " levels indicated by Table 8 and 11 and Figures 2 and 5 of D008B do not include the notch extension from 120 Hz to 80 Hz, as was requested in D008A. The change is therefore from the original waiver, not from Rev A. Further, in D008B, the "current" Table 10, and Fig 4 "Current" line is from D008A; these items should be corrected to reflect to the proper starting baseline D008.

b. The contractual status of D008A needs to be finalized.

c. Strength qualify the AOP CV2500 optics bond design for the maximum expected loads via analysis and test.

B. W014:

Background: The waiver requests that OBA S/N # 2 (which includes ATB S/N # 1 and AOP S/N # 1) , which underwent component qualification and acceptance testing at Composite Optics Inc. be cleared for use on the Flight #1 Unit. The flight unit is currently slated to see instrument level acceptance test levels in addition to other test loads as well as flight loads.

The protoflight unit , OBA S/N # 1 (which includes ATB S/N # 2 and AOB S/N # 2) underwent component level acceptance testing at Composite Optics Inc. The protoflight unit is slated to see instrument level qualification test levels in addition to other test loads as well as flight loads.

RECOMMENDATIONS Do not approve; reconsider upon resolution of W014 Action items, below.

ACTIONS: 1. SBRS should re-examine FEA Model accuracy for determining stresses (Ref 1 Section 2 excerpted here):

" (The FEA) analysis does not correlate well with the test data, especially frequency response. In reference 2, the analytic fundamental frequency prediction is much higher than test response(70 Hz v. 45 Hz). This may be because the test setup included non-flight steel kinematic mounts and a test fixture with significant flexibility, which may not match the boundary conditions assumed in the analysis. Modal survey data report first mode frequencies of 50 Hz for a flexure mounted instrument, and over 60 Hz for a titanium KM mounted instrument, which raises additional questions about the fidelity of the test data and analytic predictions in reference 2. We can conclude that OBA response during instrument random vibration testing on flight titanium mounts and a rigid test fixture will vary from the previous test measurements obtained from the mass loaded mainframe test. "

2. SBRS should provide notch extension rationale for QUALIFICATION levels for purposes of stress calculations . The notch extension rationale addressed in reference 2 uses ACCEPTANCE inputs at the mainframe to derive the notch extension. It is not clear that the notch extension specification would be the same when using QUALIFICATION levels at the mainframe. The uncertainty comes from the methodology by which the notch is converted from acceptance to qualification level (Ref. 3) and the fact that the mainframe input qualification spectrum has ramps at its ends, whereas the acceptance

spectrum does not. Also, qualification stress calculations should be done without the notch extension until this is addressed.

3. In Ref (4), are indicated two bondlines which have questionable fatigue life adequacy to survive upcoming test and flight loads. SBRS should show that MODIS Fracture Control requirements are satisfied for the Protoflight and Flight Unit OBA bondlines in question, as well as for all other structural bondlines in the Protoflight and Flight units.

4. SBRS should re-consider and re-evaluate the consequences, if any, of higher levels (from direct impingement acoustics) on the OBA in the high frequency region, and provide their evaluation to GSFC.

5. SBRS should provide instrument mechanical verification test plan(s), explicitly stating load spectra, for GSFC review WELL BEFORE TEST COMMENCEMENT. For a July, 1996 test, NOW would not be too soon to be reviewing test plans.

6. Change Title of waiver (Block 9) from " Modification to MODIS OBA Vibration Levels " to something like " Use of Engineering Model OBA for Flight" to reflect what the waiver is actually doing.

Also modify " Description of Waiver " (Block 22) from " The Engineering Model.....were subjected to.." to " The OBA (S/N # 2), including the Afocal Telescope Bench (S/N # 1) and Aft Optics Platform (S/N # 1)were subjected to .."

II. Al DeForrest (Information on the serial numbers and testing of the two MODIS mainframe graphite epoxy structures)
Subject: RE: Week # 205 Assignment Review
Author: "De Forrest, Allen L" <adeforrest@msmail3.hac.com> at Internet
Date: 3/6/96 12:10 PM

A: I sent a note to Sal yesterday designed to clarify the names and serial numbers of the graphite-epoxy structures. This note was based on the discussions that you and I had last October when the telescope confusion arose.

Two matched sets were purchased from Composite Optics Inc. Their names were chosen as:
Serial Number 001="Structural/Thermal Model"
Serial Number 002="Engineering Model"

Both were built to flight documentation. Serial number 001 was subjected to Qualification level random vibration and sine burst. Serial number 002 was vibrated at the lower acceptance level.

Subsequently the name of serial number 001 was changed to "Engineering Model" for its role in the MODIS EM instrument. There is a waiver request to allow the use of this

hardware for Flight Model 1. After approval, it will carry the appropriate moniker "Flight Model 1".

The name of serial number 002 was changed to "Protoflight Model" and there is no need to ask for a waiver.

B: Ed Tani has reviewed this issue by reading the Tom Endo recommendations and then completing his own life analysis based on composite materials and known life comsumption factors. This work will soon be in the project log as PL3095-R05712. The conclusion is that we can proceed with all planned vibration events for the Protoflight Model without damage. Ed supports the F1 waiver for use even though this unit saw Qualification level vibration testing.

III. Jose Florez (Electronics Telecon with SBRS)
Author: Jose Florez at 730
Date: 3/12/96 9:21 AM

Telecon with Ed Clement, 3/11/96, 2:30 PM

The MEM module test procedure is being released for what should be the final review cycle at SBRC today.

Several MEM boards are ready for conformal coat touch-up, and a person has been identified at SBRS to perform the work. After the rework is finished electrical verification will be conducted followed by picture taking for documentation.

Cal Control 1 and Cal Control 2 CCA testing schedule is a concern. Ed thinks the Cal 1 CCA has a good chance of making it into the MEM before MEM level testing starts. A test procedure has been written for it, and EO's for identified corrections have been submitted. Joe Kleeburg is just getting caught up with the Cal 2 test procedure and generation of EO's. Something to keep in mind is that Joe has never tested these boards. SBRS has suggested, and Ed mentioned GSFC has agreed to, start MEM testing even if one or both of the Cal CCA's are not in the MEM as long as dummy cards with simulated power dissipation are used. The Cal CCA's will receive full temperature testing at the board level.

The following is an E-mail from Ed (on 3/11/96) describing the FAM PC crosstalk problem and resolution:

Summary: When we were almost finished testing the first 404723 PC Amplifier CCA, and were performing the missing codes portion of the test for the first time with this design, we noticed missing codes in Channels 1-3, and 6. (The test equipment used to perform this function for the SAM had to be modified to accommodate the different data output structure of the FAM).

Investigations proved the problem was not due to CCA layout. After additional investigations we determined it was probably a crosstalk problem in the Postamplifier hybrid itself. We brought in Spence Lee, a retired Chief Scientist (and our analog expert), to review the problem with us last week. After looking over the design, and doing some calculations, he confirmed that this problem is probably due to crosstalk between the timing control signal going into the hybrid (Delayed Pixel Clock), and the hold capacitor and buffer amplifier on the output of the hybrid. This crosstalk causes a change in the output voltage of approximately .3 millivolts when Delayed Pixel Clock transitions from either low-to-high or high-to-low. This becomes about a 1.5 millivolt shift after an external gain of 5, and is enough to through-off the ADC if it occurs during or just preceding a conversion. Spence's calculations indicate there is enough stray coupling capacitance between the one-shots Delayed Pixel Clock controls and this output stage to account for this shift. He also concurs there is not way to fix the problem without an internal change to the hybrid.

In our investigations, we determined that this effect does not cause a problem if the transitions of Delayed Pixel Clock are moved to times where ADC conversions are not taking place. After reviewing the timing of the FAM, we determined that we could make a simple change to the Timing and Control CCAs (requiring about 10 jumpers and isolation pads per CCA) and: (1) move the adjustable range of the clock back about 30 microseconds, and (2) reduce its pulse width from approximately square wave to 30 microseconds.

These two changes assure the desired clock phasing, and in fact will improve the adjustability of the system. Before this change, the FAM was sampling about 20 microseconds later than the SAM, due to in-FAM circuit delays. Thus Delayed Pixel Clock (DPC) did not have an adjustment range that could compensate for this (as it could only add additional delay to the signal). Now DPC will be adjustable over the range of -30 microseconds to 0, or about -10 to +20 microseconds relative to the SAM. This should allow easier fine-tuning of the system, and may reduce the number of times we need to re-build the Writable Control Store. As before, the FAM timing can be controlled via DPC (over the 30 microseconds indicated) without requiring Writable Control Store changes. If you an questions, please get back to me.

Ed

IV. Bruce Guenther (Draft Comments of Science Priorities for testing)
Author: guenther@highwire.gsfc.nasa.gov at Internet
Date: 3/11/96 5:27 PM

These notes are being sent in clean-draft form. Please comment freely and return as appropriate. I am sending to only one recipient at each remote telephone site, in hopes that you can conveniently pass along to others on your team. Thanks.

Bruce

Notes from 3/8/96 Telecon:

Summary:

A teleconference review of the latest version of the SBRS I&T schedule was conducted to identify potential areas for test reductions, and to establish Science and Calibration priorities for key test events. The EOS Project Office wants delivery moved forward by about 60 days. The time planned for several important calibration and characterization tests look optimistic and high risk (e.g., RVS, spectral response, solar reflectance, SRCA and SD/SDSM check-out). Important concerns regarding the Response vs Scan Angle (RVS) test, avoidance of saturating thermal channels during the warm temperature plateau phase of the T/V test, and Solar Reflectance calibration were discussed. Deleting the integration of the EM electronics (going directly to the PFM electronics), and the subsequent removal and integration of the PFM electronics saves approximately 12 days. It appears that there is the potential for saving approximately 16 days by reducing or deleting the mass properties and acoustics tests, and reducing the system level EMI/EMC tests. Further schedule gains may be realized in the areas of the Preship Data Package preparation (19 days, which can be accomplished in part in parallel with other tests) and reducing the time planned for S/C interface simulation (9 days) and Bench Acceptance Tests at LMAS (15 days). Other candidate areas for reduction under consideration are deleting or reducing some parts of the SIS100 radiance calibration tests, the T/V tests, and the stray light specification performance verification tests, given the completion of Point Spread Function (PSF) measurements at the system level. Seventeen (17) follow-up action items are identified.

Teleconference Notes and Action Items:

1. Polarization measurement:

*[Action Item #1/MCST]. Which bands are measured for polarization sensitivity? Will Band 26 (at 1.38 micrometers) polarization be measured?

*[Action Item #2/MCST]. We need the top row of the M=FCeller matrix (the first three elements, M11, M12, and M13. We also need the reference angle between the SpMA polarizer axis and the instrument coordinate axis.(H. Gordon).

*The cal/science priority for this test should be HIGH. We can probably live with a measurement uncertainty of =B10.5% relative to <2%. Prefer to refer to this test as polarization sensitivity rather than polarization insensitivity. (H. Gordon)

2. Spectral response measurements:

*Concern: For a Rayleigh atmosphere, between 845-865 nm, SeaWIFs spectral characteristics indicate that 9% of signal for SeaWIFs will come from below 600 nm for SeaWIFs filters. There is a high risk on bands with Rayleigh scattering.

*Concern: Each band will/could have secondary transmission peaks in different places. The priority for spectral OOB measurements should be HIGH.

*Concern: Filter coating pinholes may produce very localized spectral response changes across the face of transmitting/reflecting elements.

*Concept: Can we use the integrated OOB tests to determine where spectral OOB is needed?

*[Action Item #3/MCST]. Will the SpMA be purged? It ought to be since it is probably straight forward to do. (S. Biggar)

3. Stray Light test(s):

*[Action Item #4/MCST]. A rather bright source is needed to measure far-field straylight. Determine SBRS's plans regarding this test at the QMR.

4. SRCA and SD/SDSM Integration, check-out and characterization:

*We need more detail and understanding regarding subsystem and system level check-out, characterization, and calibration of the OBCs. (P. Slater)

*[Action Item #5/MCST]. What testing and evaluation of the SRCA is accomplished before integration into MODIS? When will these results be available?

*[Action Item #6/MCST]. Assure that the SRCA will be on and data from it collected during in-band spectral measurements.

*[Action Item #7/MCST]. Determine to what extent the SRCA can be further tested and characterized during system level tests.

5. Radiance versus Solar Reflectance calibration:

*Relying only on the SIS100 radiance calibration is very risky. (P. Slater)

*[Action Item #8/Barnes]. Establish solar reflectance calibration high priority status and definition roles.

6. Transient Response test:

*[Action Item #9/MCST]. Determine how SBRS plans to measure transient response.

7. Warm Target Within Field Diffracted Light test vs. demonstration by analysis:

*Issue: Intent of the specification (all long wavelength spurious effects, including diffracted light) vs. title of the specification paragraph (which implies diffracted light).

*This test is very important. What is the threshold of pain for doing/not doing this test? (P. Menzel)

*[Action Item #10/MCST]. Determine how SBRS plans to assess long wavelength off-axis response performance.

8. Point Spread Function (PSF) measurements:

*It appears that the planned PSF measurements have not been incorporated in to the 2/23 I&T schedule. PSF measurements for all four (4) channels are regarded as high priority to Calibration and Science products.

*[Action Item #11/Weber]. Establish the high priority status of these measurements and assure that they are incorporated in to the PFM I&T schedule.

9. Characterization of thermal bands:

*If there is an either/or decision for ambient vs. T/V characterization coming, prefer T/V tests for IR characterization. (P. Menzel)

*It is important that we give special attention to spectral response characterization of the LWIR Bands that will be cutoff by the MCC CaF2 window. (P. Menzel). =20

*[Action Item #12/MCST]. Determine what special emphasis/test procedures may be required for spectral response characterization of LWIR bands cutoff by the MCC CaF2 window.

10. Response versus Scan Angle (RVS) test:

*It is truly a shame that we can not measure RVS in the MCC. We need the maximum accurate effort to measure this prelaunch. It is too risky to rely on on-orbit RVS measurement. We absolutely require the deep space view S/C maneuver if we can not measure the thermal bands RVS in the MCC. (O. Brown)

11. Thermal Vacuum test cycles and temperature plateaus:

*[Action Item #13/Barnes & Roberto]. Request in writing that the T/V test cycles be conducted with a nominal 83K CFPA temperature.

*It is essential that we gather instrument response data at 3 instrument data plateaus. The T/V warm test plateau required to demonstrate instrument survival may very likely saturate several of the thermal bands.

If the data sets collected do not meet our calibration and PAR needs, then it will be necessary to modify the T/V test plan, and add a lower warm plateau level (a 4th temperature plateau) during the temperature transition phase.

*[Action Item #14/Barnes & Roberto]. Determine, or request in writing that a full set of data be collected for all bands at 3 temperature plateaus.

*Two T/V temperature cycles are very important to the calibration and characterization of all bands.

12. OBC BB temperature sensor saturation at coldest on-orbit temperature condition:

*[Action Item #15/MCST]. Determine what changes would be required to assure that the BB temperature sensors are not saturated at the expected on-orbit worst case cold condition, including thermal model uncertainties.

13. SBRS Preship Test Data Package review (parallel vs. serial)

*[Action Item #16/Weber]. Before deconfiguring test setups, assure that the necessary data from each test will be available for running Test Data Packages in parallel to sequential testing. This can save several days.

14. PVP tests that appear to be missing from the SBRS I&T schedule:

*[Action Item #17/MCST]. Compare the latest (2/96) PVP test matrix tables with the latest I&T schedule and generate an "appears to be missing list/redline markup".

15. S/C and MODIS pointing knowledge:

*If we do not get an adequate measurement of pointing knowledge from prelaunch tests, we can determine them on-orbit, but that may take up to 6 months.

*We can not wait for 6 months after launch to get the pointing knowledge we need.

16. Track direction LSF measurements:

*Track direction LSF measurements are HIGH priority to determine the absence or magnitude of electronic and optical crosstalk.

V. Ed Knight (Prelaunch Measurements of OBC BB emissivity; Re: RE4CW: EOS-AM Initial Instrument Ops; 12/95 QMR Action Item #8)

V a) Prelaunch Measurements of OBC BB emissivity
Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 3/10/96 3:39 PM
Subject: Pre-Launch Tests for Measurement of OBC BB emissivity

References:

1. "MODIS Cal Peer Review Action Item 14--Blackbody Testing," by E. Johnson, Nov 14, 1995, PL3095-Q05524, #2604.

2. "MODIS Level 1B Algorithm Theoretical Basis Document, 1995 [MOD-02]," December 1995, in signature cycle.

3. "Determination of OBC Emissivity from BCS Radiometry," by J. Bauer, 11 August, 1995 PL3095-N05255, #2500.

4. "Gain Coefficients for Radiometric Calibration: Version 2," by T. Pagano, October 4, 1993, PL3095-M03082 1497

Introduction

This memo identifies some small recommended changes to the SBRS test procedures that would enhance our ability the collect the pre-launch value of the OBC BB emissivity that we need for Thermal Calibration.

Reference 1 identifies the methods by which SBRS will determine the emissivity of the On-Board Blackbody, which has been identified as a critical parameter for the calibration algorithm (reference 2). The first method will be to measure the emissivity of a flat plate witness sample. Since this will not include the V-groove geometry, SBRS will also determine the emissivity by comparing the MODIS response when looking at the OBC BB to the MODIS response when looking at the BCS during system level tests. Scan angle effects must be accounted for in this latter approach, but the data is the same as that collected during the radiometric calibration test, RC02 (reference 3).

This effort is complicated by the fact that the observed signal from the OBC BB is the combined emission from the BB and reflectance from the cavity. These terms are difficult to separate when the cavity and OBC BB are the same temperature, and one is only using the direct observation of the OBC BB, as discussed in reference 3.

As Dan Knowles of MCST points out, a more significant complication is that RC02 is also the test used to determine radiometric calibration. Both the master curve philosophy (reference 4) and the similar thermal algorithm in the ATBD (reference 2) require the OBC BB radiance (and therefore emissivity) to be known. Otherwise, it is not possible to calculate the nonlinear term, alpha, a second critical prelaunch parameter.

Thus we have one test attempting to measure two unknowns, the BB emissivity and the nonlinear term in the calibration of the thermal bands. Without careful attention, it is possible to collect good quality data for only one unknown. This apparently happened on the Engineering Model, where the error bars on emissivity are large, as noted in reference 3.

Recommended Changes

Dan Knowles and I believe SBRS can improve their/our ability to separate the unknowns with two small modifications to their test procedures.

1. During RC02, take a data collect when the signal measured while looking at the OBC BB is close (equal) to the signal measured while looking at the BCS. This most likely means taking a data collect while the BCS is transitioning temperatures. This would cancel out the nonlinear term alpha and allow a direct comparison of the BCS and BB emissivities.

2. During MFI-09, when the OBC BB is heated, the data collects include the BCS sector with the BCS at a known, fixed temperature. This gives us a reference point, that, used with the data collected in #1, should allow us to separate the signal emitted by the BB from the signal reflected from the cavity.

Both of these simply require SBRS to collect a few scans of additional data during tests currently in the schedule. No new tests need to be added. I am forwarding this now so that SBRS may have time to consider these suggestions before test procedures are finalized.

V b) Re: RE4CW: EOS-AM Initial Instrument Ops
Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 3/14/96 1:29 PM
Subject: Re: RE4CW: EOS-AM Initial Instrument Ops

John,

Some comments from me on your discussion with Claire about the initial activation--specifically, about your thoughts on running tests before opening the doors (kind of a "pseudo-science" mode).

This may be an item for the splinter, but I think it is important that the initial activation of MODIS post-launch include some "closed door" measurements and that these be run pre-launch. I'm thinking here mainly of the Earth View door being closed, but we should really look at what we can do with the Cooler door closed to. I'm specifically thinking of scanning the inside of the Earth View door as a functional test and pattern noise test, and turning the SRCA on to check the radiometric stability

(Operational Activity 21) and possible ecal (OA 27).

In addition to providing us with functional information "did MODIS survive?", it gives us some values we can trend with the pre-launch data for performance changes. If we spot a problem, we've got some time (day or two?) to figure things out before we'd have outgassed the blankets and want to open the cooler door.

Just another idea to throw into the mix . . .

V c) 12/95 QMR Action Item #8
Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 3/14/96 4:51 PM
Subject: 12/95 QMR Action Item #8

The December QMR action item #8 states:

8. GSFC/MCST--Clarify what concerns exist over time-stamping of data (querying from metadata).

We have had two concerns over the time-stamping of the data.

The first is that problems identified in the Engineering Model, and documented in the "MODIS Engineering Model Data SDST Geolocation Analysis Report," SDST-045, by Fred Patt, 9/95, have been corrected. These involved some incorrect time codes in the headers, and we understand that they have indeed been fixed.

The second is that the time stamps on the instrument data match the time stamps on the GSE data. This concern was discussed extensively in email in late February (messages attached). We (MCST) understand SBRS to be meeting our requirements by providing unique templates and by setting the time tags close enough tat detective work through the GSE files is possible, if necessary.

Thus, we believe that SBRS is meeting our concerns about time-stamping of the data.

Ed Knight

From tpagano@msmail3.hac.com Wed Feb 28 12:32:39 1996

Lee, Ed and Ken

We do have unique template files for each test. In all cases we provide temperatures for each new UAID and in all cases where needed, we provide temperatures for each collect! In short, all the data is in the template files.

I'm sure SBRS can get you the temperature log files, but we need to ask Vern for these.

Thanks

Tom

From: ken.anderson@ccmail.gsfc.nasa.gov on Tue, Feb 27, 1996 10:45 AM
Subject: Re: Tac Metadata

Lee and Tom,

Please see an update on an update, etc. of the comments regarding metadata. Ed seems to be willing to accept Tom's argument regarding template files, but this implies delivering a different template for every test. Is this more cost-effective than including the data in the metadata?

Ken

_____ Forward Header _____

Subject: Re: Tac Metadata
Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 2/20/96 1:42 PM

Ken,

First, we do write our own reduction files, so we do want the temperature log files delivered to GSFC.

However, that does not necessarily require them to be part of the metadata or delivered simultaneously with the instrument data. It does require that we be able to determine which temperature log files were taken with which set of science data, so the time tags, etc. need to be accurate.

The calibration source temperatures do change from test to test. If we are only going to get that information in the template files, then we need a new template file to accompany every new test. In other words, we will need a template file for the BCS calibration (RC-01 I believe) at instrument nominal, and then a new template file when the BCS calibration is run at instrument cold, and then a new template file when the BCS calibration is run at instrument hot, and the analogs for all tests using the IAC or SIS(100). This is very close to saying that we will need a new template file for every UAID.

If SBRS is willing to sign up to making these deliveries, we probably don't need to amend the actual metadata files, but that's a question of efficiency. We at GSFC need to get this data one way or another.

Otherwise, it is not possible to confirm the validity of latter tests where the template has not been updated. Nor is it possible to confirm the instrument short-term stability, if we cannot identify which changes in the data are due to small changes in the instrument performance and which are due to differences in the sources.

Ed and Company,

Please take a look at this. Tom P. believes the TAC files will already include all relevant information.

Let me know what you think.

Ken

_____ Forward Header _____

Subject: FW: TAC metadata request
Author: "Tessmer, Arnold L" <atessmer@msmail3.hac.com> at Internet
Date: 2/14/96 7:45 PM

FYI.

Lee

From: Pagano, Thomas S on Wed, Feb 14, 1996 2:33 PM
Subject: RE: TAC metadata request
To: Tessmer, Arnold L

Lee,

Yes the data (temperatures, et. al) from the sources (BCS,SVS,etc) is recorded in the log books. However, if our TAC reductions need the values, we include them in the template files that run the reductions which is delivered with the data.

In other words, I don't think they need any additional information unless they are writing their own reduction algorithms.

Data are recorded from these devices on PC's as temperature log files and information can be extracted if desired. Putting this into the metadata is more Vern's area, but I don't expect it to be reasonable since there are hundreds of temperatures recorded during a test, most of which are not useful.

Tom

From: Tessmer, Arnold L on Wed, Feb 14, 1996 10:53 AM
Subject: FW: TAC metadata request
To: Pagano, Thomas S

Cc: Therrien, Neil J

Can you give me a ROM impact?

Lee

From: ken.anderson@ccmail.gsfc.nasa.gov on Wed, Feb 14, 1996 6:37 AM
Subject: Re: TAC metadata request
To: Tessmer, Arnold L
Cc: richard.weber@ccmail.gsfc.nasa.gov; mroberto@ccmail.gsfc.nasa.gov; eknight@highwire.gsfc.nasa.gov

Lee:

And, yet another forwarded message!!!

This message concerns the metadata MODIS is collecting. As you will note, the science users are requesting the addition of certain other data in the metadata.

Would you please look at this and let me know the impact (how difficult, etc.) of collecting this data? All I'm looking for is a rough impact, not anything in detail.

Thanks.

Ken

_____ Forward Header _____

Subject: Re: TAC metadata request
Author: Mike Roberto at 420/421/422/424
Date: 2/12/96 10:06 AM

Dick and Ken,

FYI.

Mike

Ed,

FYI, at the December QMR, Vernon presented the information which was now included in the metadata (as opposed to what was collected during the EM tests). One slide provided a list of the metadata's contents and the other definitions for each item. If you don't have these slides, this is basically the same information which can be found in the STE Software Requirements CDRL (G306B/C) (metadata is defined on page 191, other fields on pp 189 through 192). Of course, I can always fax you the slides too.

With that said, the information you and Cindy are requesting still does not appear to be part of the metadata. Is there any other information (besides the BCS, IAC, SVS temperatures and SIS(100) lamp levels) which would facilitate your utilization of the PFM data? If we are going to make any requests of this nature to SBRS, then we should make them by the end of next week. They are in the process of finalizing the list of changes to the STE software required for PFM, and it sounds like we would want this to be on that list. Please let me know if you will be expanding this initial metadaa update request, or if you truly only need these additional four fields.

Rick

Mike and Rick--

Could you pass on the following request to SBRS? We would like their TAC metadata to include information on the sources viewed in a given data collect--specifically, the BCS, IAC, SVS temperatures and SIS(100) lamp levels. Currently, these are only recorded in the handwritten log books, which is problematic when we get the data FTP'ed to us, and have to track down what went into the logbook. Cindy Merrow's email presenting our need is attached.

Ed Knight

From tac@sideshow2 Mon Feb 5 17:02:37 1996
To: eknight
Subject: TAC metadata
Cc: cmerrow
X-Sun-Charset: US-ASCII
Status: RO

Ed,

It has come to my attention in discussions with Dan Knowles regarding Engineering Model Data and Dan's use of this data to derive the look-up table for the thermal algorithm that it would have been extremely useful to have BCS, IAC, and SVS temperatures included in the UAID.INFO file for the TV test in question. Dan has pointed out that he requires the SVS and BCS temperatures for a particular engineering model test in order to perform the necessary analysis for deriving the look-up table. Since this information is not available in TAC metadata we will have to take a "best-guess" at these temperatures based on information from the Logbook and test reports.

As Dan fine-tunes the look-up table based on Protoflight Model Data it becomes imperative that we have more accurate BCS and SVS temperatures i.e. BCS and SVS thermistor temperatures as were recorded during a test. Therefore, I believe we need to request that for Protoflight Model Testing that all data that is relevant to a particular test

and is not instrument data, i.e. BCS, IAC, SVS temperatures and SIS(100) lamp levels, be included in TAC Metadata.

Cindy

VI. Bob Martineau (Flight Model FPAs; Use of -9 volts for PFM NIR FPA rails will be investigated)
March 12, 1996

1) Flight Model 1 Detective Assemblies and FPAs:

- All F1 FPA's have been delivered.

2) Flight Model 2 Detective FPAs:

- The F2 VIS and NIR FPAs have been delivered. The F2 LWIR DA completed radiometric testing. All pixels are functional. The filter/bezel was received from Speedring. The FPA will be in test by March 15, and CTI is expected about March 20.

- The F2 SMWIR DA completed radiometric testing. The filter/bezel assembly was received and installed. FPA functional tests were completed with no problems. CTI is scheduled for March 13.

3) Saturation of NIR FPAs:

- Neil Therrien will investigate using -9V rails for the NIR FPA when the unit returns for final instrument test.

VII. John Mehrten (Instrument Operations)
VII. a. MODIS Reset/Upload Brief Description

By J. A. Auchter/SBRS, 2/96

INTRODUCTION:

What follows is a summary of the activities which take place after a reset to the MODIS processors. Differences between the two processors will be noted below as needed.

1: Upon coming out of reset, the Startup ROM (SUROM) is enabled. This means that the lower 32K of RAM memory (physical memory addresses 00000-07FFF) is not available. Instead, the 8K SUROM is mapped into these locations (nothing exists from 02000-7FFF in this mode).

2: The code in the SUROM performs a memory test of the physical memory RAM addresses 08000-1FFFF.

3: When this test is complete, the boot code is copied from the SUROM into two pages of RAM which passed the memory test described above.

4: Execution is then transferred into the RAM copy of the startup code.

5: The SUROM is disabled, making the RAM from 00000-07FFF visible. The newly available RAM memory is tested.

6: With all failed memory blocks located, address state zero in the processor is allocated using only pages which passed the memory test. Within address state zero, logical pages 0-6 are mapped to RAM, pages 7 and 8 are mapped to the system registers, pages 9-13 are mapped to RAM. Pages 14 and 15 were mapped to RAM during step 3 above. Operand and Instruction pages are mapped identically; that is, instructions and data occupy a single 64K unpaged address space.

7: The system register containing reset information is checked. This register exists at logical address 800A in the TCP and at logical address 801B in the Format Processor. For each of the possible resets, there is a single bit in the resets register. The bits are active low. If the bit corresponding to the upload reset is low, the processor transfers control to a small upload program, described below. If the upload bit is high, a standard reset is assumed.

8: For a standard reset, the Flight Software is copied from EEPROM addresses 80000-8CFFF to logical addresses 0000-CFFF (skipping the pages mapped to the system registers). The actual RAM addresses used will be determined by the results of the memory tests performed in steps 2 and 5, above. Note that the RAM copy of the Startup code is loaded into logical addresses E000-FFFF, which are not loaded from EEPROM. This address range is used as stack and heap by the flight software, and so does not need to be loaded.

9: Control is transferred to address 0000 of the flight software program and normal execution begins.

UPLOAD MODE.

In step 7 above, if an upload reset is detected, control is transferred to the upload code, also stored in the Startup ROM, and copied over to the RAM as part of step 3. As defined in the Flight software Requirements Specification, CDRL F306B, EDCC document 152928, the Upload code exists to provide a means of loading an entirely new program into the MODIS instrument. This would be used, for example, if the EEPROMs containing the flight software failed. The upload module is different for each processor. These modules are derived from the actual flight software by starting with the full flight software module and removing functions not required for the upload activity until the resulting code fits into the 8K Startup ROM along with the startup code described above.

In the TCP, the main functions supported in the upload mode are the 1553 interface code, the command interpreter, and the memory transfer modules. In the Formatter, the functions supported in the upload mode are the internal serial link code and the memory transfer modules. Note that this means that both MODIS processors cannot be in upload mode simultaneously, since the internal serial link is not supported by the TCP upload module. If both processors need to be uploaded with new code, the TCP can be loaded first, the new TCP program run, followed by commands to set the Formatter into upload mode for its reprogramming. The command interpreter in the TCP Upload code supports

only the commands: MEMORY_LOAD_INITIATE, MEMORY_DUMP_INITIATE, MEMORY_TRANSFER_CLEAR, RESTART

The MEMORY_LOAD_INITIATE and MEMORY_DUMP_INITIATE commands behave as in the flight software, with the following exceptions: 1) Table load and dumps are not supported, as the flight software to which those tables refer do not exist in Upload mode. 2) accesses to the Format Processor are not supported, as noted above. The MEMORY_TRANSFER_CLEAR command cancels all load and dump transactions currently in progress. The RESTART command specifies a jump address which is the starting address of the newly loaded program.

POSSIBLE CONFLICT

In upload mode, the MODIS instrument cannot generate telemetry as defined by CDRL 305. There is not enough room in the 8K Startup ROM to support this. Options for the Housekeeping Telemetry subaddress are as follows: 1) Disable this subaddress so that no telemetry data is generated by the MODIS instrument. 2) Enable the subaddress, and place a fixed set of data into it. This would require defining a single bit, which would indicate that the telemetry data is not to be used for ground processing (or for any other reason).

Will either of these solutions, disabling the subaddress or enabling with a fixed buffer and a Not_For_Ground flag (TLM_NFG) result in alerts being set off on the spacecraft or the ground which would need to be disabled before sending the upload reset command?

VII b. OASIS Cmd Hazard Msgs

Author: "Mehrten, John A" <jmehrten@msmail3.hac.com at Internet
Date: 3/9/96 1:18 PM
Subject: OASIS Cmd Hazard Msgs

Claire,

o Hazard Msg Format - - I have a question about the style of OASIS cmd Hazard msgs. Is the msg annoucement of common form for all items classified Hazardous, or, are they tailored to the specific cmd with unique comments.

o MODIS Screen Hold Items - - I think I may have copied you on earlier msg that I was going to split T10-25 Cmd List into T10-25A and T10-25B since we didn't have a good vehicle to note hazards/constraints. Then I'll add a column to T10-25A "Safe/Use" to lay in a single letter code as needed to designate cmds as:

H = Hazardous, C = Constraint, T = Test, A = Advisory.

A constraint example is where door unlatch cmds must be sent within 10 sec of a SW unlock cmd. Many cmds are primarily to facilitate test activities. An advisory merrily adds meaningful info to the Remarks Column.

T10-25B would only contain the related coded items in T10-25A (except the T codes), and be only a few columns in extent. It would very briefly note the nature of the Hazard, Constraint or Advisory.

o MODIS Msg - - We will probably use a common msg form for all Hazard or Constraint items, once we select the msg words. Some samples:

"CAUTION - - THIS COMMAND COULD PRODUCE A HAZARD OR VIOLATE A CONSTRAINT - - VERIFY INTENT TO EXECUTE IT"

"CAUTION - - HAZARD/CONSTRAINT COMMAND - - VERIFY INTENT".

It would get very arduous to specify the exact nature of hazard/constraint, but could be done. It will be in T20-25B.

Note that the hazard/constraint might apply at several cmd levels: 1) the single cmd, 2) a cmd in a gnd cmd procedure sequence (gnd macro), 3) a cmd in a Flt SW macro, or 4) a cmd in the CP07 Mode cmd sequences.

o Gnd Test/Orbit Deltas - - For MODIS, some differences will exist between the gnd test scenario and on-orbit ops. For example, once on-orbit and activated, the door unlatch cmds will not have further meaning. Cmds to move the scan mirror will no longer be a hazard to personnel. Etc.

Different aspect example, which may or may not exist according to how gnd cmd procs are assembled. If the gnd test proc contains a H or C cmd in its macro, one might only hold the macro at the front end. Or one might also lay the hold inside the macro. If the latter approach was used, It would be ok for gnd test, but not workable for on-orbit ops.

On-orbit ops hazards/constraints would normally only be laid into to the assembly of an upload cmd sequence due to the autonomous nature of on-orbit ops. That is, once assembled and uploaded, there would not normally be real time intervention into cmd sequences. There may be a few exceptions to this.

This and other ops issues may get flushed out in the upcoming 4/96 Ops Workshop.

VII c. Ops Activity Remarks/C&T Status
Author: "Mehrten, John A" <jmehrten@msmail3.hac.com at Internet
Date: 3/10/96 4:34 PM
Subject: Ops Activity Remarks/C&T Status

Ed, This msg provides remarks on your 2/27 msg below, and a status/advance outlook at the 151840 MODIS C&T document. The msg is primarily addressed to you, other TOs s/b CCs, but I took advantage of email Reply_All.

There might be a question if such a large dist is appropriate for this msg. I believe it is, as it contains timely topics. The clock is ticking very fast, and I wanted to provide advance, commonbase info about updates for the 151840 document.

1. Sample Ops Activities - - Your msg provides samples of: Activity Definitions, Constraint Definitions (2 levels) and Mode Definitions. I believe all of your samples are good for each of the items.

As noted in Item 2 below, some of the MODIS details will be revised. But these are details, and DO NOT AFFECT the basic concept contents in your msg.

There is one terminology issue to note. In your msg Ref#2, I described the CP07 SET_CP_OPER_MODE cmd sequences to be "macros". Flt SW Joe Auchter tells me, these technically are not macros (even though they quack like them to most of us). I will soon correct terminology in a modes memo update.

2. 151840 Update - - The object of providing this update info, is to allow end users to know where to focus their near-term activities if they are actively using the document info now. This is because rapid revisions will occur in the near-term.

2.1 The document will move to engineering release next week with an expanded spec title of 151840 MODIS Command, Telemetry, Science and Engineering Description in order to establish a controlled baseline for PF Flt SW and GSE SW updates. Although it always looked a spec, it had only been submitted to GSFC as combined CDRL 303 cmds & CDRL 305 telemetry. The format is the same with added features.

2.2 Revision content strategy is as follows. For the initial release, I am striving to complete updates for basic T10-25 cmd & T20-2 tlmy lists, T20-4 tlmy framing, and T40-1 cmd & tlmy responses. Other near-term releases will address scale factors & alarm limits for T20-5 active analog tlmy & T20-6 passive analog tlmy. Sci (FPA sensor signals) is unchanged. Last will be eng pkt updates, which are mostly a repartitioning of pkts with updates in some fields.

2.3 To those that have not used this document before, be advised that it's beginning contents covers(ed) comprehensive data for HW & SW design development, I&T plng, end user interests and ops plng. Thus, the large C&T tables contain a variety of info not of interest to all users. So don't be confused about some columns that have no meaning to your interest.

2.4 Some content/format remarks - -

a. The document contains about 415 cmds & about 457 tlmy words. It has 59 tables, however only about 25 of them contain hard core controllable data. The other tables are a

part of the educational orientation content. Even though it will be a new release, the hard core tables will each contain unique chg# IDs from EM, that are explicitly described in a change history at the end of the tables. This is to maintain the CDRL continuity for prior user orientation
/experience.

b. Memory pkts have gone away, and been re-allocated to be eng data. The major contents now fall more cleanly into bins for cmds, tlmy, sci and eng data, where sci specifically refers to FPA data. There used to be times of confusion with mixed terminology of sci tlmy vs eng data, sci FPA data vs sci data, sci eng data vs eng data, although context generally provided the intent.

c. One significant format update, is that Cmd table T10-25 has been parsed into T10-25A and T10-25B. T10-25A is the same as T10-25 was, except a Safe/Use Col has been added to code applicable cmds as H = Hazard, C = Constraint, A = Advisory and T = Test. T10-25B would note the nature of H, C & A w/o all the reference info cols of T10-25A. An advisory is additional, meaningful info to the Remarks in T10-25A.

4. MODIS Modes Update - - Although this is a part of the 151840 update, I wanted to highlight it with more focus. On the surface, the chgs to be noted are rather benign. But the subtle nature of one chg, provides a major cornerpin for a consistent set of mode operations. Chgs/remarks follow.

a. Sci Mode - - Will have a minor chg to add precautionary cmds to turn Off the rdt sides of the only 3 subsystems that can simultaneously be On (SA scan assy, PC FAM & PS, power supplies are direct S/C pt-pt cmds).

b. Safe - - As you have already noted in your msg, Safe will be defined as a minimum pwr condition with the CP On. Initially, it was defined this way, then it went to a nearly-sci config in your msg Ref#2. But, it will return to a minimum pwr config, except it will include the Radiative Cooler 3-stage tlmy for additional temp data (this takes negligible pwr). This might slightly mitigate the repeat cooldown recovery time after being in Safe with the space view door closed. This definition also fits nicely into the initial on-orbit activation with the re-definition of Standby (next item).

c. Old Standby - - Standby has always been our standby/utility mode, and can end up with a variety of configs. The current definition of Standby in your msg Ref#2 is also a nearly-sci config. I'll present the new definition followed by remarks of how it provides new consistent glue (or is it grease) to our modes operations.

d. New Standby - - The new definition is whatever the prior mode config was, except cmds would be issued to turn off some high pwr users, like, the OG htrs, the heated BB and the SRCA. So the exceptions mean the OG/Sci Mode would have Sci but not the OG htrs. The basic Sci Mode would continue to exist, but supplemental OBCs would be

Off. Doors would be in whatever prior state they were in, etc. Some advantages to this definition follows.

e. First On or Reset, What Is It? - - We've always been plagued with, what do we call when power is first applied, or if a pwr transient has resulted in an automatic PS reset. Standby, because of its diversity, fills this niche w/o having to have explicit mode assignments.

f. First On Ops - - It facilitates first On Ops as follows. We would go from Survival to Safe, and sit awhile. The next step is Standby, and because Safe was the prior mode, we have a secure config to start other Ops, such as, turn on other subsystems for a quick check, or, unlatch doors if we're ready, etc.

g. Upload Config - - If we have a major SW upload (vs patches) we ultimately want to be Safe since during this type of load we would temporarily lose normal 1553 C&T bus capability (only have limited capability). The convenient way to get there is go to Safe, then to Standby, and we again have a secure config for a major SW upload w/o having to define an explicit "Upload Mode", which we did in the early days.

h. Consistent/Minimum Mode Set - - Several of us believe, that with this fine mode tuning, we have achieved defining a consistent minimum set of modes that covers all operations.

From: Ed Knight on Wed, Feb 28, 1996 2:18 PM
Subject: DRAFT Action Item Response

MODSOT folks. (The TOs were all the GSFCs on my dist...JAM)

This is the draft of a memo. Please provide any comments by March 6, 1996. If no comments are received by this date, the memo will be sent to Ed Chang and FOS. Thank you.

Ed & Kirsten

To: Claire Wilda, Rick Broome

From: Ed Knight and Kirsten Parker, MODIS

CC: Ed Chang, Bruce Guenther, John Mehrten

Date: February 27, 1996

Subject: Sample Scheduling Data Needs

References

1. "MODIS Operations Concept Document, Version 1.3," by Kirsten Parker and Ed Knight, December 20, 1995. (Currently in signature cycle.)

2. "MODIS Modes & Related Macro Commands," internal SBRS memo by John Mehrten, PL3095-M04239, September 12, 1994.

3. "MODIS Engineering Telemetry Description," CDRL 305, SBRS, April 1994.

4. "Sample Scheduling Data Needs," FOS Scheduling, December 6, 1995.

Summary

An action item due March 1, 1996 as listed in Reference 4 states, "Provide the accommodation engineers with several text examples of: Activity Definitions, Constraint Definitions (activity level and command level), and Mode Definitions." This memo is in response to this action item and contains all requested information. The first cut of Operational Activities are fully listed in Reference 1. A sample activity is presented here. The commands listed here for this activity are also found in Reference 2 and Reference 3.

Activity Definition

Name of Activity: MODIS_Outgas&Science_Mode_Transition
Instrument Resource: MODIS Instrument (MODIS MODE)
Responsible Person: Kirsten Parker
Description and Comments: The activity includes the following spacecraft stored commands:

Stored Command Parameter Relative Time
CP01 TURNON_CPA
PS08 ENABLE_PS1_SVHTR
PS09 ENABLE_PS2_SVHTR
PS06 ENABLE_PS12SHDN
PS01 TURN_ON_PS1 20 sec delay if PS was off
CP07 SET_CP_OPER_MODE TO OG
The following is one of several macros (stored in the MODIS memory) and contained in CP07.
Other macros are for transition to other modes.
CP04 ENABLE_CP_IMOK
CP06 SET_CP_TMF_BUS TO A
BB03 TURN_OFF_BB

SM03 TURN_OFF_SM
SR03 TURN_OFF_SR
RC01 TURN_ON_RCLWTLM
RC05 TURN_ON_RCSMTLM
RC10 TURN_ON_RCCSTLM
RC14 TURN_ON_RCISTLM
RC18 TURN_ON_RCOSTLM
RC07 TURN_OFF_RCSMHTR
RC03 TURN_OFF_RCLWHTR
RC11 TURN_ON_RCCSHTR
RC15 TURN_ON_RCISHTR
RC19 TURN_ON_RCOSHTR
CE01 TURN_ON_CEA
TG01 TURN_ON_TGA
PC04 TURN_OFF_PCLW
PV23 TURN_OFF_PVLW
PV15 TURN_OFF_PVSMIR
PV01 TURN_ON_PVVISA
PV07 TURN_ON_PVNIRA
SA05 SET_SA_HIGAIN
PV31 SET_PV_MEM TO RAM
SA01 TURN_ON_SAA
FR01 TURN_ON_FRA
FR06 SET_FR_FPA_DCR TO ON
FR07 SET_FR_RATE TO DAY
FO01 TURN_ON_FO_BLK1
FO02 TURN_ON_FO_BLK2
FI05 SELECT_FI_PORTA
FI01 TURN_ON_FIA
DR08 TURN_ON_DR_DRV
DR10 MOVE_DR_NAD TO OPEN
DR09 MOVE_DR_SVD TO OPEN
DR11 SET_DR_SDD_DRVA
DR13 MOVE_DR_SDD TO CLOSED

Constraint Definitions

The following are an initial list of constraints for the MODIS_Outgas&Science_Mode_Transition activity. These constraints are subject to change.

Activity Level Constraints:

1. Activity shall begin during real-time contact only.

2. Activity shall not occur during field campaigns (OA-11, ref. 1)
3. Activity shall not occur during radiometric check on thermal band linearity (OA-26, ref. 1).

Command Level Constraints & Prerequisites:

1. Command CP07 cannot be sent when MODIS is in Launch Mode. (Launch Mode = No Power)
2. Command CP07 cannot be sent during blackbody heater on. (CR_BB_A_PWR_ON=3D1)

Mode Definitions

The Mode Definitions are taken from the MODIS Operations Concept Document, Version 1.3.

The MODIS operational modes define subsystem configurations to perform particular mission functions. The primary operational mode is the Science Mode. The remaining modes are: Launch Mode, Survival Mode, Safe Mode, Standby Mode and Outgas & Science Mode.

The Science Mode is evenly divided in two parts: Day Mode and Night Mode Day and Night mode are each functional for 50% of the time. (Note: this request has been submitted to Project but has not yet been approved.) Day Mode is fully functional with a data rate of 10.6 Mbps and is coincident with the sunlight portion of the orbit. During Night Mode only bands 20-36 are collected on earth scenes with a data rate of 3.2 Mbps.

Launch Mode is the configuration for launch consisting of doors closed and manually latched, all subsystems and power supplies off, and survival heaters disabled. Once exited, a return to Launch Mode is not possible because manual door latches cannot be relatched on-orbit.

The Survival Mode is a minimal power mode in which only essential functions (e.g., survival heaters) are supported. Transition into Survival Mode causes non-essential instrument functions to power down. Power supplies are off. Doors are closed. Survival heaters are enabled. All subsystems are off. Survival Mode is entered and exited only by direct command from the ground or S/C. Upon realization that the instrument is in Survival Mode, the FOT performs failure analysis procedures to identify and isolate the failure.

After isolation of the failed component, the FOT executes a predefined recovery strategy, agreed upon with MODSOT, to transition the instrument into the desired mode of operation. Survival Mode and Safe Mode differ primarily in power consumption.

The Safe Mode places the instrument in a protected state where it is capable of independent operation. Safe Mode is expected to be entered when the S/C has lost lock on the Earth and will be transitioning to Sun orientation or the S/C is preparing to enable thrusters for attitude control, momentum unloading or orbital maneuvers. Safe Mode will also be entered as a result of various hardware failures detected in the telemetry (TBR). Power supplies are on. Doors are closed. All subsystems are off with the exception of the Command and Telemetry processor. Safe Mode is entered by direct command from the ground or S/C or by the absence of the IMOK message from the SCC for five major cycles. If Safe Mode is entered autonomously, the FOT performs analysis procedures to identify the cause and execute any necessary recovery strategies following procedures agreed upon with the MODSOT.

The Standby Mode is entered to establish and maintain instrument thermal stability prior to transition to Science Mode. All mechanisms are returned to their home positions. The doors may be open or closed. Command and telemetry are supported, however high rate science data is not.

The Outgas & Science Mode configures the MODIS to a ready state for outgas of the instrument and allows for visible and near infrared (VIS/NIR) science data to be collected. In Outgas & Science Mode, power supplies are on, command and telemetry is supported, cold and intermediate stage outgas heaters are on, and the space view door is in the outgas position. Outgas & Science Mode replaces the old Outgas Mode because VIS & NIR band data will still be collected [SBRC PL3095-M04239].

(NOTE: The figure doesn't show up in this text-only version.)

Figure 1: MODIS Operational Mode Flow

VII. d. RE: Ops Activity Remarks/C&T Status
Author: "Mehrten, John A" <jmehrten@msmail3.hac.com at Internet
Date: 3/10/96 9:36 PM
Subject: RE: Ops Activity Remarks/C&T Status

Ed, This msg provides typo correction to 1st msg & minor FYI bean count remark.

o In 1st msg 2.4.a - - cmd count s/b 215 cmds, not 415.

o In 1st msg 2.4.c - - FYI count on new cmd codes are Hazard=22 (~10%), Constraint=19 (~9%), Advisory=30 (~14%) & Test=32 (~15%). 10&15% #s grossed.

(P.S. - - I notice Kirsten has another internet address under the big tent. Is that a spin-off from "highwire"?)

1st msg Reference:

From: Mehrten, John A on Sun, Mar 10, 1996 1:33 PM
Subject: Ops Activity Remarks/C&T Status
To: Large Dist

VII. e) MODIS Ops Issues
Author: "Mehrten, John A" <jmehrten@msmail3.hac.com at Internet
Date: 3/12/96 5:20 PM
Subject: MODIS Ops Issues
---------- Message Contents ----------
Claire, This msg summarizes ops topics that were briefly addressed in separate prior msgs. Some aspects have remarks. They fall into the FYI and potential 4/96 ops mtg topics.

1. MODIS Resets/Uploads - - Joe Auchter generated a page description of our Reset and major Upload process. This is enclosed as a RTF file (Rich Text Format), which we were able to go crossplatform with before. The point Joe makes at the end in Possible Conflict, is that we will not have normal 1553 C&T capability in a major upload case. I suspect other instruments may have the same problem.

In my 3/10/96 remarks msg to Ed/Kirsten/MCST sample activities msg, I also gave the 151840 Cmds, Tlmy, Sci & Eng Description status. This included the announcement that our Standby Mode is defined as prior mode except for turn-off of a few high pwr items. And, that this definition accommodated several ops configurations, but was still consistent with the ops process. This variation provides a home to do major uploads by first going to Safe, then to Standby and then proceed with the tailoring to do the upload process. (And as noted before, it nicely covers, what do you call it when pwr is first applied, or you automatically recover from a pwr glitch, etc.)

2. APIDs - - I think GSFC_MODSOT/LMMS/SBRS are in basic agreement with the APIDs issue, if I pass on that Joe A will include Flt SW capability to associate a unique Pkt Seq Count with each MODIS 64 APIDs stored in memory. Most of the time they wont be cycled since we will probably only use one APID for Sci, Eng & Test Pkts.

One APID issue that globally persists, and wasn't addressed in our prior telecons, is how will EDOS account for intentional/unintentional power off Pkt Seq Count gaps? I imagine most instruments are alike in this regard, that if pwr goes, RAM goes, and baseline Pkt Seq Counts go.

3. Initial On-orbit Activities Strawman - - In today's GIIS Chg telecon you indicated you'd send prior typical activities related to TM activation.

One of my prior msg questions on this topic, was if any of the EOS-AM instruments had priority items to check, or, will it be simultaneous instrument ops for the most part? How long might some of the outgassing periods be. Is there concern over some S/C or instrument system having a lot of outgasing to do, such that others shouldn't open their doors until a certain time from this aspect. I'm not experienced in this area, so I can't imagine an impact of this nature. Perhaps I have the cart before the horse, and should have first asked will it take many orbit adjustments to establish the desired orbit parameters, prior to starting ops (with outgass & door unlatch/open downstream--but space view door would have an early unlatch because we outgas about 5#161#open).

That's all the topics I can recall w/o checking (I thought there was 1 or 2 more).

VII. f) RE4CW: EOS-AM Initial Instrument Ops
Author: "Mehrten, John A" <jmehrten@msmail3.hac.com at Internet
Date: 3/14/96 1:04 PM
Subject: RE4CW: EOS-AM Initial Instrument Ops

Claire, Thanks for the advance FYI. Even this little bit helps to get the mental wheels moving - - especially the 8-day number. Related to that, from a S/C pwr capability, I assume orbit tweaks, don't affect solar panel performance, such that, instruments will be able to turn on some subsystems for some initial checks during this 8-day period. In the case of MODIS (& others I assume), we might have some limited ops time with the doors closed even though S/C pwr capacity is there.

What I'm musing about is how far we can go with partial Sci, and say, turn On SRCA for functionality ck. There might be a number of thing we could check. I think we could probably manage on-time periods w/o exceeding thermal constraints due to long thermal time constants. I'll need to get some guides from Ron Choo.

For closed door ops check out, we will not be able to use CP07 Mode cmds other than Survival/Safe/Standby because OG & Sci contain open door cmds. CP07 already has a Hazard designation from safety test motion aspect and orbit aspect for door-unlatch before moving doors (which covers closed door ops).

Gnd cmd sequences (vs Flt SW macros) would be defined to handle general on-orbit activation.

From: cwilda@eos.vf.mmc.com on Thu, Mar 14, 1996 6:40 AM
Subject: EOS-AM Initial Instrument Ops
To: Mehrten, John A

Cc: cwilda@eos.vf.mmc.com

----- Begin Included Message -----

Date: 6 Mar 1996 22:20:54 -0800
From: Mehrten, John A <jmehrten@msmail3.hac.com
To: "Wilda, C./LMMS" <cwilda@eos.vf.mmc.com
Subject: EOS-AM Initial Instrument Ops

Claire, Maybe it's available, and I just missed it. Has there been an initial activation scenario mapped out for the instruments?

***** We have started this. What we have will be discussed at the Ops W/S
*****
***** in April. We plan to send it early in order to get comments from
*****
***** everybody at the W/S. Actually, we base our plan on what we get
*****
***** from the IOTs.
*****

o I assume the S/C has main priority to get it properly configured and oriented.

***** Yes.
*****

o After that I assume for the most part, it would be parallel ops for all instruments. But some may have some subsystem that needs priority care in the early activation process.

***** Yes.
*****

o The kind of thing I wonder about

What orbit would instruments first be turned ON for the first quicklook at their tlmy, which in most cases is going to be like a SAFE mode configuration.

***** MODIS has said that turn on must be 12 hours LV sep 20 hours.
*****
***** other instruments have different constraints.
*****

Then probably go to some in between level of config.

***** Yes. Usually Standby to check commands & telemetry.
*****

Do all instruments have outgassing conditioning of some form (which might be passive for some)?

***** I think they all have to. I don't know details. MODIS, MOPITT, and
*****
***** ASTER TIR & SWIR all have coolers. I have to believe they outgas.
*****

For MODIS, when might we unlatch our doors, and start outgassing? Are we talking a few orbits or a few days?

***** This is your call. It was a few orbits on Landsat 4 & 5, but we got
*****
***** to orbit fast. You will hear at the W/S that we won't get to orbit
*****
***** (and will still be firing thrusters) for 8 days. I guess you won't
*****
***** want to begin outgassing until after that.
*****
----- End Included Message -----